Accelerator Systems Division Highlights Ending January 21, 2005

ASD/JLAB: Cold Linac

Assembly of the H-12 and H-2 cryomodules continues on schedule.

H-11 was shipped to ORNL.

ASD/BNL: Ring.

January 18 shipment from BNL: quadrupole doublet #2 and the repaired injection septum magnet were shipped this week.

January 25 & 27 shipments from BNL: two containers are being prepared for next week's shipments:

- Injection kicker magnet (short) and stand; wall current monitor (RF); RF power supply; vacuum chambers - 3 Ring and 10 RTBT; PLC for HEBT vacuum controller; balance of BLMs (4 boxes ~ 220 units); LANL motion chassis and cables (one box).
- HEBT Vacuum PLC chassis; ten (10) each IDEC 24 V power supplies for HEBT/Ring/RTBT marked attention Derrick Williams at SNS/OR.
- Seven (7) electron detectors
- Quad doublet #1 for the collimator straight section

February 1 shipment from BNL: Injection line magnets and associated support stands (chicane 2, chicane 3 and chicane #4).

The vacuum chamber for the #2 injection dump septum magnet is being reworked for proper assembly fit.

Final assembly continues on the K2 extraction kicker magnets. Bake-out blankets are being fitted to the vacuum chamber. The assembly will be ready for shipment in early February.

Alpha Magnetics has six coils wound and four potted. Jim Rank is at Alpha this week for an engineering inspection of the final magnet assembly. Alpha plans to ship on 2/1/05.

RTBT 17D224: Pioneer Steel has completed all machining of the magnet core. They are waiting for assembly hardware that has been on order. They plan to ship within 10 days.

36Q85 quads: two have been measured; one is in progress; last one is ready for magnetic measurements.

IPM chambers are being prepared for TiN coating.

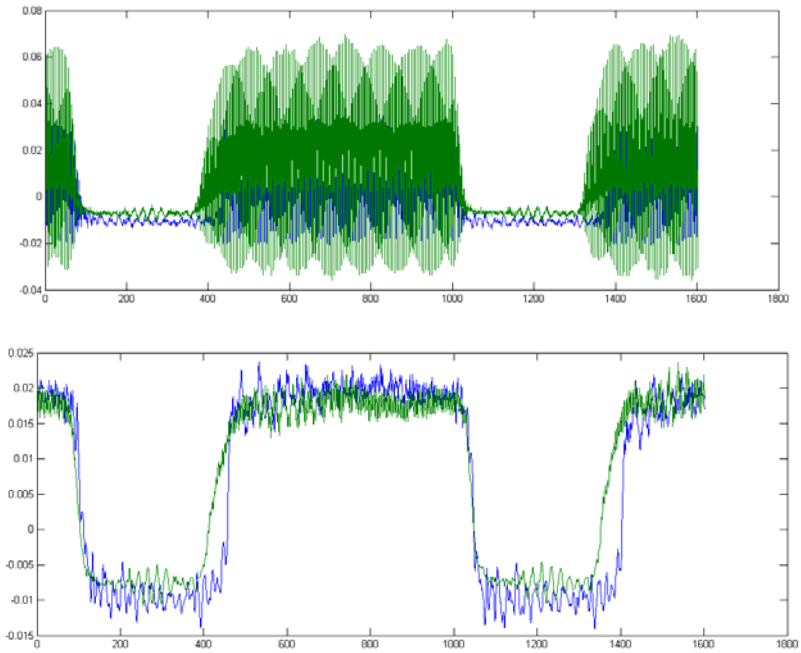
Controls

The console prototype was reviewed, a meeting was held with the contractor (DCS) and decisions were reached on a number of design changes. DCS is now ready to proceed. The value of making a full prototype was manifest. A plan was generated and reviewed for the acquisition of Control Room computers, monitors and network equipment. The Target Protection System (TPS) chassis was delivered to DCS who will add the seismic mount. Termination of communications cables resumed in the CLO Central Equipment Room (CER), Software Development Area (SDA), and Central Control Room (CCR).

Yury Eidelman continued his visit to SNS/ORNL in the pursuit of three goals: The deployment of tools for configuring and managing alarm handler (AH) and associated log files; the deployment and demonstration of Graphical User Interface (GUI) applications for display of timing system performance based upon event link data; and deployment and demonstration of the GUI application to configure and manage the Ring RF system.

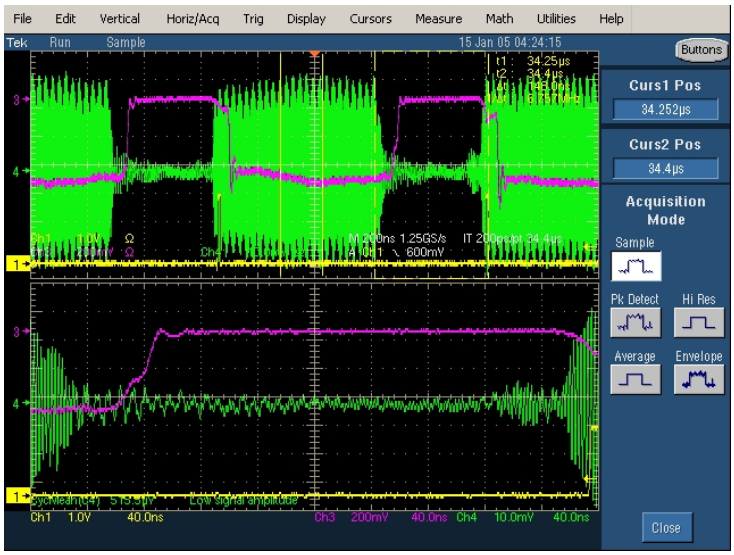
The new VxStats software appears ready to deploy after several problems were fixed.

LEBT / MEBT Chopping tests were conducted at the end of last week (too late for last week's report.). The results are promising as seen below. The top figure shows the high bandwidth current monitor signals digitized at 1 GHz. The second figure shows the BCMs after using MATLAB to put the data through a 200MHz low pass digital filter. The MEBT clearly cuts the rising edge time from ~40 nsec to ~10 nsec.

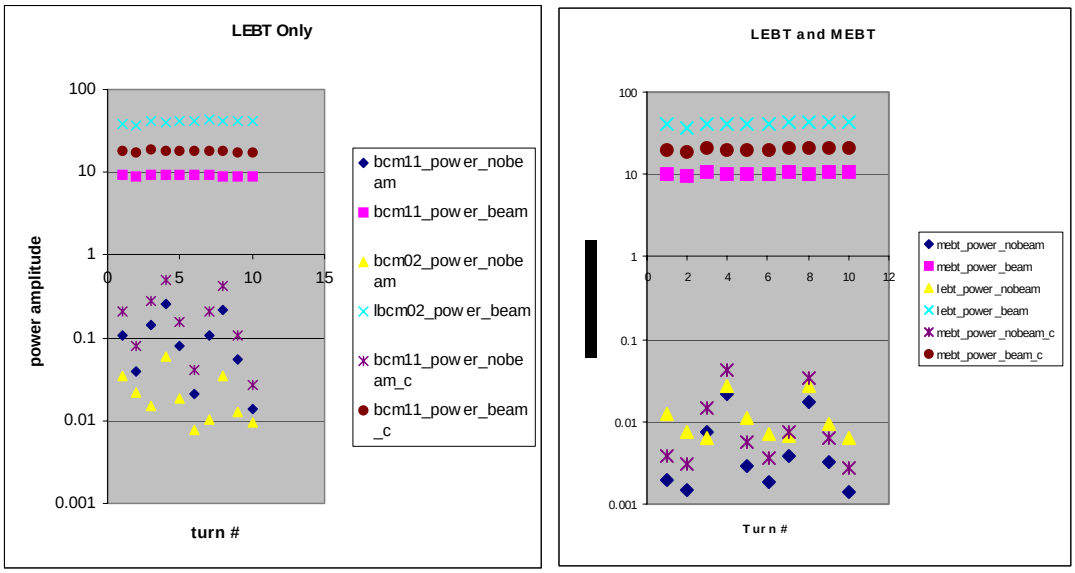


Timing was set up locally using a raw BPM signal and the raw MEBT_BS signal. High bandwidth signals showing the beam current (or BPM power) are needed in the control room for efficient timing setup between the LEBT and MEBT. The figure below shows the trailing edge delayed too long with respect to the LEBT.

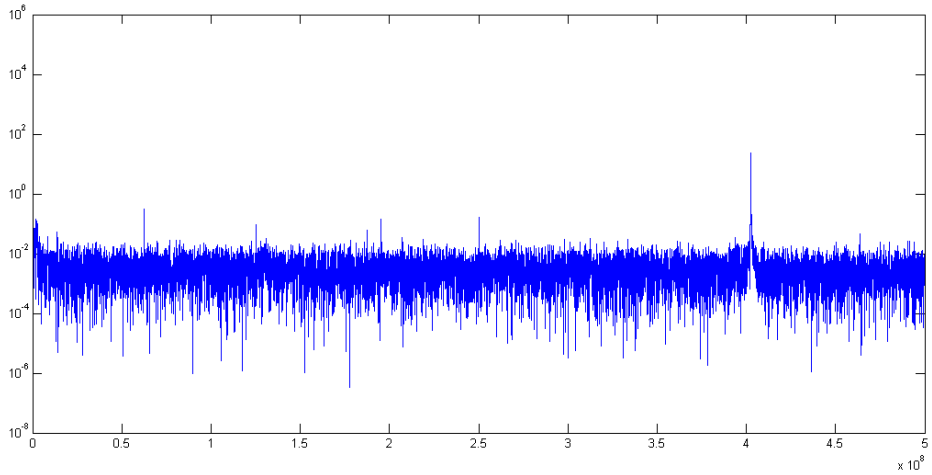
In an attempt to measure the extinction ratio we did a Fast Fourier Transform (FFT) for 245nsec during the beam off



and compared it to an FFT while beam was on. The power was calculated and is shown below for 10 consecutive mini-pulses. The LEBT and MEBT plot shows the effect of chopping the slower rising edge of the beam.



Data was taken for 20 usec before beam was turned on. The noise floor is ~10e-2; however the 402.5 MHz is still picked up from the RF systems. (See below.)



Although these tests have to be considered a success, some problems remain. Switch problems in the LEBT continued but were not fatal. Errant rep rates faults occurred but went away after the equipment was shut down for an hour. One of the high voltage supplies in the MEBT Choppers shut off for no apparent reason approximately every 10 minutes. Design work continues on the next-generation LEBT Chopper Controller.

New LLRF software was installed on SCL and DTL1&3 using R3.14.7, new FCM bitfile,
a new timing overview that shows all the gates & delays for the various pieces of the LLRF, with some new configuration Process Variables for what used to be static offsets and an option to latch RF off on vacuum faults.

Development began on a new LLRF application that will help with cavity characterization, allowing entry of various losses for cables, waveguides, etc. and then calculation of the various power levels. This may be implemented using Python, in preparation for which the Python extension for EPICS was ported to EPICS v. 3.14.

Ring communications cable design is close to complete. The Ring RF MPS hardware will be moved into to Ring RF Control Room, the timing master crate still needs to be located. (The ideal location in the Ring RF Control Room probably doesn't work because of insufficient available space.

Installation of communications cables continued in Klystron Building rack rows 23 through 27.

Conventional Facility (CF) screens were updated on the accelerator server to make the views from the CUB control room and main control room the same. Alarm Handler displays for CF cooling water flows, operational status of pumps, fans, etc have also been made available in both control rooms. In collaboration with PSSO, problems with IP addresses in the CF PLCs are being addressed so that their status can be monitored more effectively.

Installation

Craft Snapshot 1/18/05

ASD productive craft workers	**66.0**
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	75.0
Less WBS 1.9, 1.2 etc	**16.0**
Less absent	**6.0**
TOTAL PD BY ASD/ORNL DB WPs	**44.0**

Accelerator Physics

Irina Popova presented intermediate results to the Radiation Working Group on Wednesday, Jan. 19, on radiation model calculations for the end of the RTBT beam line. The radiation levels were lower than previous calculations, suggesting that no additional shielding is needed between RTBT quadrupoles Q28 and Q29. Once this work is documented and verified, the next step is to address the details of the gamma blocker to be installed just upstream of Q26. After that work is complete the next issue will be the radiation levels at the RTBT dipole magnet DH13, due to backscattering from the target.

The document "SNS Magnet Polarity and Coil Lead Labeling Conventions and Magnet Wiring List," SNS 110020000-II0004-R00, is now fully signed off and in the hands of the document control center.

The Magnet Polarity document which contains the polarity definitions, magnet polarities and wiring lists for all electromagnets was completed, signed-off, and submitted to DCC.

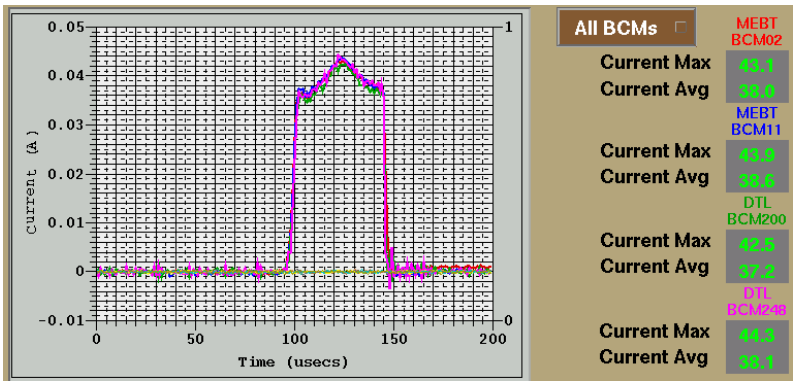
T. Pelaia has excellent agreement between the Ring online-model and MAD for the linear optics and closed-orbit. More data was taken to provide emittance and Twiss measurement in the early CCL from wire scanners. Emittances are in the 0.3 pi mm-mrad range (rms, normalized) with 15-20% error bars.

A. Shishlo is now running the ORBIT code with the e-p node on the NERSC supercomputer for PSR benchmark simulations of electron cloud development.

Operations

Ion Source

The ion source, which produced nominal current after a record short startup time, maintained its high performance level up to the end of CCL1-3 commissioning. The figure shows the last commissioning shot with an average current of 38 mA.



Survey and Alignment

S&A completed the pre alignment of the warm section raft assembly with the laser diagnostic box. Once this assembly is relocated into its respective position in the LINAC tunnel, we will perform the final alignment to ideal position.

Additionally, S&A pre aligned the two 8Q35 magnets on one warm section raft located in the Magnet Measurement area of the CLO. The raft is ready for transport to Building 8330 for installation of the beam pipe. From there, it will be transported to the top of the ring where the magnets and beam pipe will be final aligned before movement to the LINAC. At this moment, (Friday morning) S&A's alignment of SCL components is completely up to date. There are no components waiting for our services.

S & A has completed the integration and update of old PPS drawings for the HEBT, Ring, and RTBT. These new drawings will provide the installation group with enough definition to begin working on the configuration of the gates, etc.

The RTBT monthly deformation monitoring campaign was completed; data to follow soon.

S&A is performing an as-built of the shine door located in the Hot Cell area of the Target Building. We performed an as-built of the same door approximately one month ago when the shear blocks were tack welded. This is an as-built with the shear blocks fully welded into place.

We set elevation markings on the forms of section 1 of instrument line four for the high density concrete pour that is scheduled for January 24th.

The Survey and Alignment Group is in the process of packing, moving, and re-organizing all equipment into the new shop space in the basement of the CLO.

Mechanical

We have begun the removal process for the DTL-CCL commissioning beam dump from its shielding coffin. Initial radiation measurements look reasonable and the residual continues to drop.

Some testing of the RCCS is continuing on a few cavities to add to our database of information.

All planning is in place for the upcoming month shutdown which includes the removal of the shielding wall between the warm and cold linacs and the final work on CCL4.

Warm Sections

- We now have 17-8Q35's left to measure.

- Warm sections are installed from MB3 through MB11. HB01 and HB02 will be installed next week. HB03 is ready for alignment. HB04 is being assembled next to the clean room.
- MB03, 04, 05 and MB07, 08 Magnet Power has been checked out.
- Vacuum is connected on MB03, 04, 05, 06, 09 & 10.

Water Systems Installation

- Installation of the SCL ME06 HVCM and SCR cooling system continued.
- Installation of the SCL ME08 rack cooling system was started.
- Installation of the SCL Cryo Warm Section Magnet cooling connections continued.
- DI water is flowing to all the HEBT magnets up to the Ring tunnel intersection.
- Installation of the RING SB Power Supply cooling system manifolds continued.
- Installation of the RING SB PFN cooling system manifolds continued.
- The SCL Warm Section pressure wash system was repaired and returned to service.

Ring Systems Installation

- The Ring Injection straight section upstream Doublet Magnet assy was installed.
- The Ring RF straight section upstream Doublet Magnet assy was installed.
- The Ring RF straight section downstream Doublet Magnet assy was received and staged for installation.
- The Ring Injection straight section spare Injection Septum Magnet assy was received and stored in RATS II.
- A meeting was conducted to status all the remaining design/fabrication/procurement for the remaining Ring items.

Electrical Group

SCL ME5 testing is complete. Installation/checkout of SCL ME6 is underway.
SCR unit for SCL ME7 was delivered from Dynapower and installed in the Klystron Gallery

Linac Tunnel – Cable terminations for SCL module HB-5 and HB-6, warm section terminations

SCL ME-5 area – diagnostics, controls and vacuum terminations in progress
SCL ME-6 area – cable pulling and ac power installation in progress
SCL ME-7 area – cable tray and rack installation
SCL ME-8 area – ac power terminations in progress

Ring – ac power terminations for RF systems, PPS wiring, and rack installation for diagnostics room in progress.
CLO Control Room – terminations in progress

Completed integrated magnet/power supply/controls testing for SCL warm section MB-7, bringing the completed warm section integrated magnet/power supply/controls tests to 5 of 34.

Completed integrated magnet/power supply/controls testing for HEBT_MAG:PS_QH04_06, bring the number of completed HEBT integrated magnet/power supply/controls tests to 1 of 22.

HPRF

Ring RF,

- Submitted SRO for ground plane installation.
- Coordinated with electrical team to complete SRO for Ring RF control room rack/cable tray installation.
- Coordinated with electrical team to provide racks to replace the short roll-around racks delivered with the driver amplifiers.
- Determined safety grounding configuration for Amplifier and Cavity

LLRF

Cryo Group

Cryomodule HB11 was received this week. The two remaining cryomodules (HB12 and HB02) are in various stages of assembly at JLab.

During the past five days four new cryomodules have been tested, all at 4.2 K: the replacement of MB07, MB09, MB10 and MB11.

MB09 and MB10 had not been previously cooled down or tested at JLab. The couplers went to a peak power of 250 kW (administrative limit) in a short time (at most a little over an hour).

Cryomodule MB11 had had a feedthrough replaced in situ due to a leak and it had not been tested again. Two of the cavities had no problem reaching the design gradients. The center cavity that had the feedthrough replaced showed initially heavy multipacting that cleared up after a few hours of processing at low field and power. Presently is limited by the transmitted power through the HOM filter and its limits are being investigated. The tuner in cavity MB09b has limit switches out of range at 4.2 K, but it should be within specs at 2.1 K

Although for not all the cavities the limiting fields were explored, a substantial fraction of them considerably exceed the design values with short pulses in instantaneous, open loop conditions. In most cases pulse lengths of 600 microseconds were utilized and 10 Hz repetition rate, condition which provides information about Lorentz force detuning, stability, maximum gradient, without unnecessarily loading the cryogenic system.

A few cavities are being limited by transmitted power though HOM filters, but in most cases at gradients higher than the design value.

Several cavities have been operated in closed loop at 10 MV/m and the procedures to optimize the loop parameters is being worked on. As many as 8 cryomodules have been run simultaneously for several hours at a time.

MB08 is cold and ready for testing and HB01 is being prepared for cooldown.

Within a few days we will have nine medium beta cryomodules and part of the first high beta cryomodule running in conditions capable of accepting beam. By the middle of next week testing will cease for over a month during PS reconfiguration

Beam Diagnostics

SCL Installation

- Work on rack installation was deferred by Jim Diamond and Dan Newby's trip to BNL.
- The vacuum valves air lines interfere with Laser system junction boxes installed at HB08 and HB11. The resolution to this problem has not been formalized.
- Work is in process to update SCL cabling documentation for the addition of Neutron Detectors and the new Laser scanner located at the downstream end SCL HB21.

HEBT Installation

- Electrical inspection has been completed by Paul Holik with two exceptions to be cleared;
    - The circuit breakers were installed upside down.
    - There are a few places where the conductor is exposed from terminals.
    - Paul was happy with our installation.
- This work has not started.

Ring Installation

- Rack installation has begun. Andy found that the crafts were working from old documentation and the racks were being installed in the wrong places. The problem has been resolved but at the expense of re-work to correctly locate the racks IAW the current Ring drawings.

General tech support

- We have a preliminary plan for HV Bias Supplies for the SCL NDs and the FBLM systems. The rack and cable documentation modifications are in progress.
- The rack and cable modifications are also in progress to add LW32 and move the laser camera system that was at LW32's location.
- Items 1 & 2 are a primary focus for next week because these changes are holding up our cable pulls.
- Timing Test Bed and special projects as defined by Jim Pogge and Saeed continue to dominate Syd's work load.

Software

- Laser Profile Monitor: Igor has synchronized the rad hard camera and continues to work with Labview.
- Laser Beam Box: Work is nearing completion.
- Demoed watchdog timer.
- Platform: Adding of health monitoring in progress, watchdog.
- Ch0 improved, docs getting ready.
- Visit arranged: 26-28th of January, still go!
- Paperwork for extending a software developer through ORISE has been completed.
- Meet with Aqiris rep: previous candidate card for the DBCM is no longer an option but a new card is soon available.
- Long term requirements for the RTBT BCM RTBT still need to be refined. This work is beginning.

PC Platform

- Completed Self Install Disc for both the 845 and 865 motherboards. These include the SP2 build with LabVIEW 7.1
- Updated device data for Ring and Beyond. Completed BPM, BCM, WS, BLM, ND.
- Implemented first version of Channel 0 - site information system
- Performed inventory of rack mount PCs– requested quotes from General Technics.

CLO Lab

- The estimates are in but we have not yet received word on any progress.
- Dan Newby is helping to come up with estimates for lab furniture but we have no budget defined and the lab space renovation has not been approved, so this work is very low priority.
- Training is required for Lab managers. Andy had a briefing with Sam McKenzie to go over the Research Safety Summary. Detailed lab plans for all four of our lab areas have to be developed, Mezz, HEBT laser room, C-141, and C-143.

Tom Shea, Jim Diamond and Dan Newby traveled to BNL for a 1.5 day visit. A detailed trip report will be released.